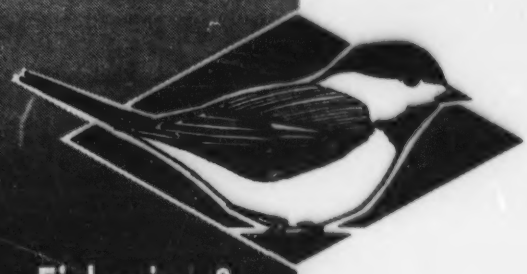

Fisheries & Wildlife Management Division

RESOURCE STATUS AND ASSESSMENT BRANCH

Utilization of Air Photo Interpretation to Locate Prairie Rattlesnake (*Crotalus viridis viridis*) Hibernacula in the South Saskatchewan River Valley

Alberta Species at Risk Report No. 22

Alberta

102-07136/

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Joel Nicholson

Selwyn Rose

Alberta Species at Risk Report No. 22

July 2001

Alberta
SUSTAINABLE RESOURCE DEVELOPMENT

Publication No.I/028
ISBN: 0-7785-1815-9 (Published Edition)
ISBN: 0-7785-1816-7 (On-line Edition)
ISSN: 1496-7219 (Published Edition)
ISSN: 1496-7146 (On-line Edition)

Cover Illustration: Brian Huffman

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This publication can be cited as:

Nicholson, Joel and Selwyn Rose. 2001. Utilization of Air Photo Interpretation to Locate Prairie Rattlesnake *(Crotalus viridis viridis)* Hibernacula in the South Saskatchewan River Valley. Alberta Sustainable Resource Development, Fisheries and Wildlife Management Division. Alberta Species at Risk Report No. 22. Edmonton, Alberta.

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Acknowledgements

The authors wish to thank a number of individuals for contributing to this project. Dale Eslinger was instrumental in the initial ideas and project development. Robert Wolfe and Blair Watke conducted the initial habitat stratification and mapping for the study area. Lana Robinson from the Fish and Wildlife Resource Information Unit contributed mapping expertise and products for the project. We would like to thank the Prairie Region Resource Information Unit for producing the Figure 1 and 2 maps.

Executive Summary

Current anecdotal evidence suggests that the distribution and abundance of the prairie rattlesnake is declining. Due to a lack of standardized information, a means of conducting a landscape level hibernacula inventory and population assessment of rattlesnakes in Alberta must be developed. Previous work undertaken by Alberta Environment, Corporate Management Services was done to attempt to facilitate this process. This method used air photo interpretation and the Ecological Land Classification system to classify a portion of the South Saskatchewan River valley for the likelihood of containing snake hibernacula. This method was evaluated for effectiveness by conducting ground searches throughout the identified study area and correlating actual locations of confirmed snake hibernacula to predicted locations. A total of eight hibernacula (seven previously unknown to investigators) were confirmed. Of these confirmed locations, 75% fell within areas predicted to contain snake hibernacula. Overall, this predictive tool seems to be valuable for targeting priority areas on a landscape to be searched for snake hibernacula. Further refinement and development of this predictive tool may serve to increase its effectiveness.

Introduction

The prairie rattlesnake (*Crotalus viridis viridis*) reaches the northern limits of its North American range in southern Alberta (MacArtney and Weichel 1993, McCorquedale 1965). The prairie rattlesnake is distributed along the major river drainages in the southeastern portion of the province (Cottonwood Consultants 1987, Gannon 1978, and Pendlebury 1977). It appears that geographical limits restrict the population distribution of the prairie rattlesnake in Alberta to the

major river drainages where suitable denning sites are available (Gannon, 1978). A study in southern Alberta completed by Gannon found only one out of 35 hibernacula outside the major river drainages. Gannon reported that others had reached similar conclusions in related work on distribution.

Current data available regarding rattlesnake population numbers in Alberta cannot be used to make provincial population estimates, as the data is not standardized nor is it long-term (Rice 2000). The Prairie Rattlesnake is classified as a Blue list species by the Status of Alberta Wildlife 1996 and is considered may be at risk (Alberta Environment 2000). Even so, the information found from short-term research and occasional sightings is too limited to clearly state their status. This situation was reflected by the classification of the prairie rattlesnake as Data Deficient by the Alberta Endangered Species Conservation Committee (ESCC) in February, 2000. At this time the ESCC also recommended year round protection for rattlesnakes and their dens, as well as additional research aimed at determining the rattlesnake population size, distribution, and trend. An amendment to the provincial regulations was made in May 2000 to extend protection for this species.

Watson and Russell (1997) reported there was enough anecdotal information to suggest that distribution and abundance of the Prairie rattler has declined in Alberta. Other historical records indicate that the distribution was greater than at present (Cottonwood Consultants 1986, Pendlebury 1977, Russell and Bauer 1993). It is thought that such a decline may be due to various factors including habitat loss, intentional persecution, high levels of road mortality, and increased industrial development. Currently much of the compiled information to suggest this trend is somewhat anecdotal, as an intensive search and documentation of active hibernacula sites combined with a population assessment and monitoring has not been carried out.

Due to the relatively large range of the prairie rattlesnake in Alberta, a methodology to establish a comprehensive and efficient search for hibernacula requires development. Previous work done by Wolfe and Watke in 1997 describes the probability of finding prairie rattlesnake hibernacula using air photos and the Ecological Land Classification system. It is, however, uncertain how useful these remote sensing and land stratification techniques are for locating hibernacula.

The primary purpose of this study was to conduct a ground search to verify whether the probabilities determined through previously accomplished habitat stratification work on a section of the South Saskatchewan River valley using aerial photography actually corresponded to hibernacula sites located on the landscape.

Study Area:

The study area was located along the South Saskatchewan River, about 30 kms north of Medicine Hat, Alberta (Figure 1). This multi-use area contained the eastern portion of the river valley within TP. 15 R.5. W4M and TP. 16 R.5 W4M and the eastern and western portions of the river valley within the northern half of TP.14 R.5 W4M. Total area was approximately 90 square kilometers. Both privately owned land and Crown land under grazing disposition makes up this area.

The study area is found in the Dry Mixed Grass Subregion, with the climate being characterized by some of the lowest precipitation amounts in any ecoregion of Alberta (Strong 1992). It has a typical continental climate with cold winters, warm summers and low precipitation (Achuff 1994). Winter temperatures are affected by common Chinook winds in the area.

The study region is made up of the South Saskatchewan River valley lowlands and the coulees and secondary drainages flowing from the upland grasslands. Upland landforms are comprised of glacial and eolian deposits, creating rolling, hummocky moraine hills and sandhills. Long, deep valleys, ravines and canyons have been created by surface and secondary drainage runoff into the valley bottom and river below.

Soils are usually brown chernozems with regosols and brunisols found in the river valley (Strong 1992). The area is dominated by native vegetation, with a mixture of grasses, forbs, shrubs and trees. The exceptions to this are areas on glacial fluvial terraces where irrigation and cultivation has occurred.

Fig. 1 Location of Rattlesnake Study Area

Methods

A 1:25,000 scale map was prepared by Corporate Management Services, Prairie Region, Lethbridge, Alberta, and overlaid with polygons representing ecologically similar landscapes with the probability of containing rattlesnake hibernacula rated from one to 25. This map was used to correlate the hibernacula probability polygons, with a 1: 50,000 topographic map, air photos and a 1:15,000 scale map (with corresponding polygons), in order to perform a ground search of the study area.

In July, August, and September 2000, ground searches for burrowing animal dens were completed throughout the study area by walking through areas represented by the polygons. The high probability areas (22-25) were concentrated on, then the moderate(15 -21), low (10-14) and unlikely (1-9), searched respectively. Suggested high probability hibernacula site locations were examined by looking at landforms, slope, drainage, animal accessibility, aspect, stability, vegetation and condition of habitat. Moderate probability areas were searched with the same intensity as the high probability areas. The low and unlikely areas were searched around perimeters and cross sections, looking for suitable signs and conditions such as mud mounds and dens created by the presence of burrowing animals or crevices in rocky outcrop landforms.

The ground search concentrated on finding burrowing animal den and tunnel systems, presently inhabited or not, that the prairie rattlesnake may use for a winter hibernacula. Each den site was examined on the basis of size and number of entrances, aspect, geological location, how the den was created (looking at fissure faults, sinkholes, rocky outcrop caves and crevices), drainage and overall access for snakes from nearby grasslands.

When a potential den or series of potential dens was found, the Global Positioning System (GPS) location and a site description, the size and number of entrances, and the aspect was recorded in a field notebook for each site. The location of the single or multiple dens was also plotted on the 1:15,000 air photo. When an area was searched and no dens were found, a location and brief description was recorded. These areas were also recorded on the map to show it had been searched and no den sites were found.

Den sites where multiple rattlesnakes were found in late August or September have been recorded as hibernacula. It was assumed that snakes were gathering for hibernation at these locations.

Results:

The potential dens were often found in unstable slump zones, along escarpments created by the meandering South Saskatchewan River. These type of den sites were found most often in the southern half of the study area, where the river has several past and current meander channels. Terraces, created by slumping along unstable slopes, have slight depressions or sinkholes, loosely packed soil, and fissure cracks or small faults. Patches of sagebrush and other plants are often present on these terrace micro-sites. The foliage was observed to provide security cover and shade near entrance locations for rattlesnakes, bullsnakes and various small mammals.

Secondary drainages and coulee slopes provided a number of dens created by mammals and dens formed from runoff, now used by mammals. These dens were often single entrance holes found at the base of slopes, thus providing poor exposure to sunlight. The dens did not often have multiple entrances and were not usually developed extensively.

Fewer potential den entrances were found in the north section of the study area where the river has fewer meanders. Most slopes faced an overall west direction on this part of the river. Steep, eroding slopes often cut off the lowlands below from the upper slopes and plains. The steep, eroding slopes did not provide many stable, terrace micro-sites.

The potential den sizes and the number of entrances varied. Den entrance size was expected to be determined by the size of the burrowing animal (rabbits, ground squirrels, gophers, badgers, and coyotes) that created or maintained the den. Den entrances ranged from approximately five to sixty centimeters in diameter. It was also noted that some den entrances were very large (>30 cms. in diameter) and visual inspection was possible on some occasions up to five meters into the ground. Most den entrances were medium sized of about six to 15 cms in diameter. Often,

smaller entrances (<six cms in diameter) were found adjacent to medium and large entrances, *usually running in a series of numerous entrances and tunnels in a line. Small entrances did exist* on their own, found more often east of the river.

Dens of burrowing animals were typically found in areas receiving the most sunlight, thus utilizing south aspects. Rattlesnakes observed sunning in the morning hours, at dens in August (possibly gravid females) were noticed to face a southeast direction. Rattlesnakes observed at hibernacula in September sat near the hibernacula entrances, facing the south. In the case of potential den entrances found on 'terrace flats', the series of holes would be located where they received the most sunlight. Some potential den entrances were noted at the very top lip of south facing, eroding slopes.

The ground search of the study area, during July and August, turned up a total of 131 potential den sites, created and/or used by mammals. Time constraints did not allow a September re-visit to every potential site identified. Several likely looking potential sites in various areas were chosen to re-survey in September to give an indication of the success in finding a hibernaculum. There were eight hibernaculum sites confirmed within the study area (Figure 2). Confirmed hibernacula were noted to have multiple rattlesnakes sunning near the den entrance. One site was a previously identified site known as the Davies dens, and the remaining 7 sites were previously unknown to investigators. Two different sets of hibernacula, are noted to be in proximate areas, but are believed to be separate hibernacula. Two out of the eight hibernaculum were found in areas suggested as having high probability by remote sensing techniques. One hibernaculum was found within a moderate probability polygon. Three hibernacula were found within low probability polygons and two sites were found within unlikely polygons (Table 1).

Table 1 - Number of Confirmed Hibernacula Contained Within Classified Likelihood Polygons

High	Moderate	Low	Unlikely
3.3% of study area	3.4% of study area	7.6% of study area	85.7% of study area
2	1	3	2

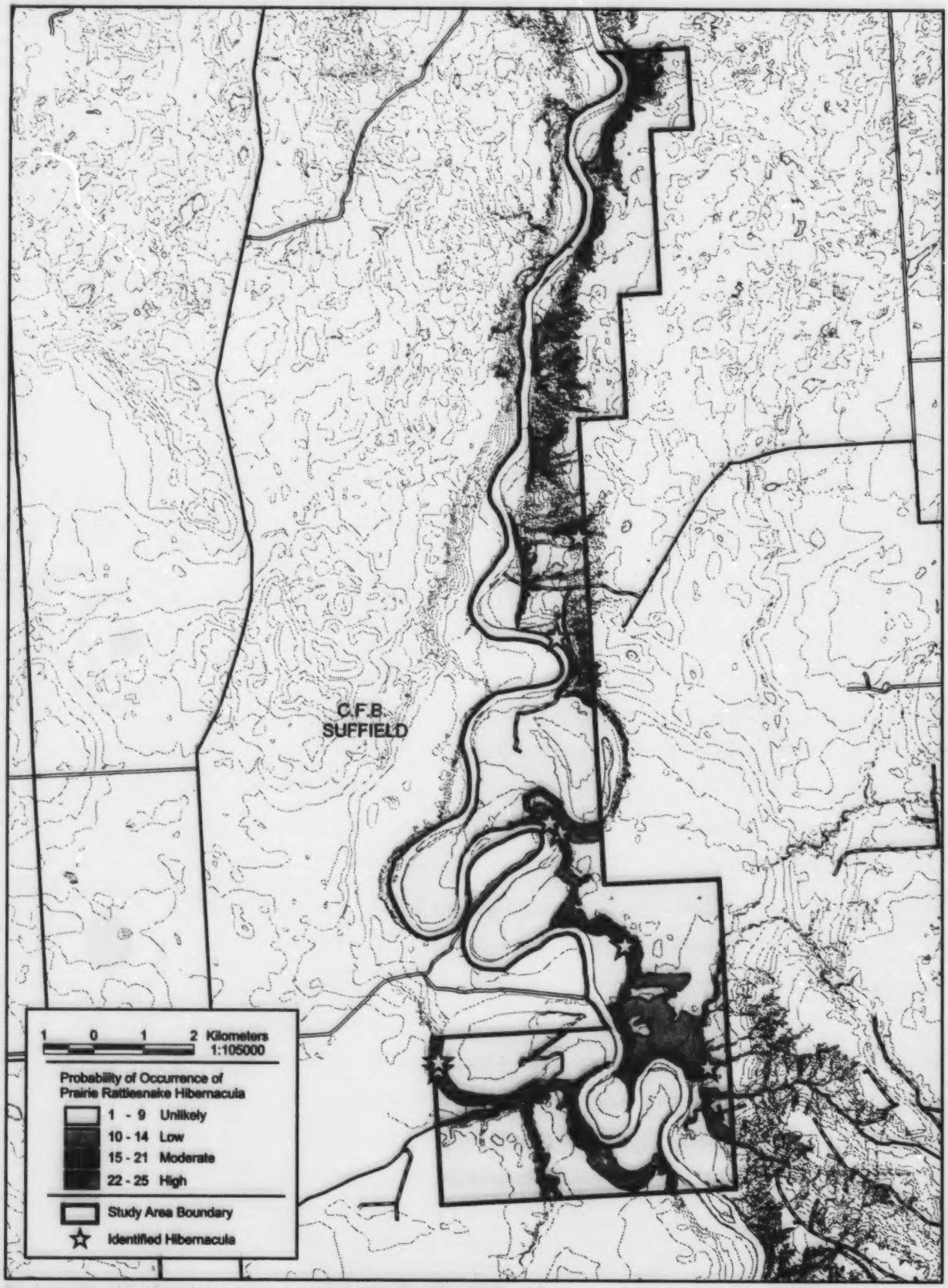

Fig. 2 Location of Confirmed Hibernacula Contained within Classified Likelihood Polygons

Discussion

Once habitat classification was completed, only 14.3% of the study area was identified as having some degree of likelihood of containing rattlesnake hibernacula. The remaining 85.7% was deemed unlikely to contain snake hibernacula. Results showed that 75% of confirmed dens fell within the identified 14.3% of the study area predicted to contain snake hibernacula. The remaining 25% of the dens were contained within the unlikely polygons. These results indicate that a high proportion of hibernacula sites were located within the classified polygons, and would suggest that the stratification exercise does capture the majority of suitable hibernaculum sites. It should also be noted that sites located in the unlikely polygons, while they were indeed outside the more likely categories polygons, were found in very close proximity to higher likelihood areas. These sites were also located in micro-habitats exhibiting similar characteristics to the areas classified as being likely to contain hibernacula.

Seven previously unknown snake dens were located during the course of this study. This is a considerable finding as it shows that using remote sensing techniques in conjunction with ground searching resulted in finding new rattlesnake hibernacula. This said, the two hibernacula that were found in the unlikely categories, suggest that the remote sensing technique is not totally accurate. The criteria and special micro-site conditions that may be required for a potential site to be used as a hibernaculum, still remains a vital part of considering possible rattlesnake hibernacula locations. Variables and other conditions that may not be evident from air photos, but become notable on the ground include micro-site ecology, snake accessibility, and habitat disturbance. Ground searching reveals micro-site topographical features, such as slump zone fissures or cracks, which possibly allow snakes to reach below the frost line into the underlying bedrock.

Many hibernacula found on terrace slump zones were found with entrances near sagebrush patches. The rooting of these plants may aid the burrowing animals, by possibly giving support and stability to the hole by providing a type of infrastructure to the tunnel. The soil may be easier to dig, as well, along a root system where soil may be loosened by rooting action. Further

analysis of vegetation present at den sites may elucidate the significance of this characteristic to hibernacula sites and serve to refine the predictive tool.

A considerable amount of time is invested with intensive ground searches. This technique can be used to locate probable areas and intensive ground searches may result in finding snake hibernacula. It should be noted that in this study the confirmed hibernacula found outside the likely areas, were subsequently found while gaining access to the high category areas or traveling within the study area. The current remote sensing techniques can be used to minimize ground searches by avoiding searching unnecessary areas, but at present should not be relied on completely.

Importantly, the technique of using such a remote sensing system was found to allow for organization in the ground search. As areas are outlined in specific categories and mapped, these can be used to segregate the areas according to the probability rating and search them in some order determined by the researcher. The stratified mapped polygons can be used to ground search in an organized way, as the polygons follow the landform and topographical features visible on the ground.

Management Implications and Future Directions

A major component of the conservation of the prairie rattlesnake in Alberta will be based on protection of denning sites. These critical over-wintering sites will also provide a means of population assessment due to the annual aggregations of snakes prior to the onset of winter. Confirming the locations of these important sites across the range of the rattlesnake will be key. It is clear that a means of effectively targeting areas on the landscape to increase the efficiency of ground searches conducted for snake hibernacula is a necessity. The current predictive tool is valuable in this regard, however further refinement of this method incorporating additional detail and other site characteristics could hopefully contribute to increasing the effectiveness. This work should be undertaken as soon as possible in order to facilitate use of the habitat stratification process for a landscape level hibernacula inventory.

The necessity for a landscape level hibernacula inventory and subsequent protection of den sites of prairie rattlesnakes was reinforced during the course of this study. Investigators found two pipelines surveyed and ready to be routed near a rookery in one case, and in another, through the middle of a current hibernaculum with rattlesnakes already gathered at the dens. The pipeline surveyed through the den was scheduled to be constructed only two days after the den was found. Both of these pipelines were rerouted away from the dens, however these problems are most likely occurring across the landscape.

Hibernacula located in this study were also found to have roads and trails associated with oil and gas development constructed in close proximity to them. Associated road mortality was also confirmed on a number of occasions. Future work using this technique to locate snake hibernacula will allow for better planning of such activities to hopefully reduce negative impacts on snake populations.

Literature Cited:

Achuff, P.L. 1994. Natural Regions, Subregions and Natural History Themes of Alberta. A Classification for Protected Areas Management, Prepared for Parks Services, Alberta Environmental Protection, Edmonton, Alberta.

Alberta Environment. 2000. Status of Alberta Reptiles. URL:http://www.gov.ab.ca/env/fw/status/reptiles.html. Alberta Environment, Alberta Fish and Wildlife. (Accessed September 01, 2000)

Cottonwood Consultants. 1987. Alberta Snake Hibernacula Survey. Unpublished report for the World Wildlife Fund Canada, Wild West Program. 53pp.

Cottonwood Consultants. 1986. An Overview of Reptiles and Amphibians in Alberta's Grassland and Parkland Natural Regions. Unpublished report for World Wildlife Fund Canada, Wild West Program. 53pp.

Gannon, V. 1978. Factors Limiting the Distribution of the Prairie Rattlesnake. Blue Jay 36:142-144.

MacArtney, M., and B. Weichel. 1993. Status of the Prairie Rattlesnake and the eastern Yellow-bellied Racer in Saskatchewan. Provincial Museum of Alberta Natural History Occasional Paper No. 19, Edmonton, Alberta.

McCorquedale, B. 1965. Some particular aspects of the biota of the Cypress Hills. Alberta Society of Petroleum Geologists 13th Annual Field Conference Guide, Part 1.

Pendlebury, G.B. 1977. Distribution and Abundance of the Prairie Rattlesnake, *Crotalus viridis viridis,* in Canada. Canadian Field-Naturalist 91(2): 122-129.

Rice, C. 2000. Pilot Monitoring Plan for Prairie Rattlesnakes (*Crotalus viridis viridis*) in Alberta. Unpublished report for the Alberta Conservation Association. 10pp.

Russell, A.P., and A. M. Bauer. 1993. The Amphibians and Reptiles of Alberta: A Field Guide and Primer of Boreal Herpetology. The University of Calgary Press and the University of Alberta Press, Calgary/Edmonton, Alberta. 204pp.

Strong, W.L. 1992. Ecoregions of Alberta. Prepared for Alberta Forestry Lands and Wildlife, Edmonton, Alberta.

Watson, S.M., and A.P. Russell. 1997. Status of the Prairie Rattlesnake (*Crotalus viridis* viridis) in Alberta. Alberta Environmental Protection, Wildlife Management Division, Wildlife Status Report No. 6, Edmonton, Alberta. 26pp.

Wolfe, R. and B. Watke. 1997. The Application of Air Photo Interpretation in Locating Rattlesnake Hibernacula South Saskatchewan River Valley, Medicine Hat, Alberta. Unpublished report prepared for Dale Eslinger, Natural Resources Service, Medicine Hat, Alberta.

Appendix 1 – Incidental Wildlife Sightings

Various other wildlife observations were made during the course of the study. Incidental observations were made of the Bull Snake (*Pituophis melanoleucus*), but often outside the study region. These observations include snakes observed sunning or traveling near roads, roadkilled snakes, and nest mortality. On August 30th, three Bullsnake nests were observed to be depredated and some of the partially eaten eggs were scattered about the ground. Evidence of 46 eggs in total was found on the ground in front of the apparent rookeries.

One observation was made of the Western Hognose Snake (*Heterodon nasicus*). A roadkilled specimen was found and collected on the east of the South Saskatchewan River, on Bowmanton Road on July 11th. (Specimen deposited at Alberta Environment, Medicine Hat.)

Five incidental observations were made of the Northern Leopard Frog (*Rana pipiens*). Three were located at the Wetland Conservation Site, Old Channel Lake. One sighting was on the South Saskatchewan River, and one sighting was in a dugout.

All locational information collected during the study was provided for entry in the Biodiversity Species Observation Database (BSOD).

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